

FINDINGS IN THE LEPROUS CORNEA WITH THE SLIT-LAMP MICROSCOPE

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Findings in nodular iritis of the leprous eye on examination by the slit-lamp microscope were first reported by Peter in 1924. Since then Pillat, Boshoff (1), Kennedy (5), and others have reported on the changes in the leprous eye observed by the same means. Vale (11) in particular has pointed out the importance of the capillary network in the limbus corneae; and Pillat, and also Elliot (2) have stated that the earliest change in the eye is a sheath-like or bead-like lesion in the corneal nerve. These investigators have reported that the slit-lamp microscope is of great aid in the early diagnosis of leprosy, determination of its duration, and also determination of the effect of treatment or the course of the disease.

As long since reported in detail by Mitsuda (9), and more recently by Vale (11), the limbus corneae plays an extremely important role in leprous conditions of the eye. The rich capillary and lymphatic networks are similar to those of the skin, the flow is slow and venous pressure is low, making ideal conditions for the fixation of leprosy bacilli. Furthermore, the capillary network in the limbus controls the nutrition and protection of the cornea, and it is related to the iris and ciliary body. It is also connected with the episclera and conjunctiva by the vessels in the iris, and these sites are favorite locations for leprous affections of the eye. In the early diagnosis of the leprous eye with the slit-lamp microscope, the condition of the limbus corneae should be considered first, especially the capillary network and the formation of leprous nodules.

The normal corneal nerves are to be observed as fine lines that generally gleam like silken threads. A triangular or nodular thickening, like the web on the feet of water birds, formed by the perineural fibrillar substance and branching of the nerve—that is, the floating membrane—can be seen physiologically at the fork (10).

Biomicroscopical observation of the leprous eye often reveals a sheath-like thickening along the corneal nerve or a bead-like change, especially at the fork (2, 4). Differentiation of the physiological floating membrane and the bead-like change in leprosy is not difficult. In the former, the thickening has a grayish color and the free edge is semilunar in shape and concave, while in the latter the thickening is seen as a white gleaming, round, bead-like mass.

The early leprous changes which next appear, following those in the corneal nerve and limbus corneae, are pannus corneae and iritis. It has

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repeatedly been reported that the slit-lamp microscope is very useful in the search for these changes and in following their course.

An interesting question is that of relationship between the type of the disease and the findings in the cornea. Various investigators agree that, although there is a difference in frequency, the bead-like or sheath-like changes of the corneal nerve are found in all cases. Opinion is divided, however, regarding the changes in the limbus corneae and keratitis, some observers (e. g., Elliot) (2, 3) stating that these are found in all cases while others (e. g., Mendonça de Barros) (6-8) hold that these are absent in the neural tuberculoid types. This question is related to that of whether examination of the leprous cornea with the slit-lamp microscope is useful as a supplementary means of diagnosing the type of the disease and is an important clinical problem.

PRESENT STUDY

The purposes of the present study were (a) to observe the changes which take place relatively early in the eye in leprosy, and (b) to determine the relationship between the type of the disease and the lesions of the eye. To that end the corneas of 103 leprosy patients in the Nagashima Aiseien were examined with the slit-lamp microscope. These patients were divided into four groups according to age.

For the first of these objectives, 42 patients under 15 years of age (Group A) were selected and studied in detail. For comparison, as representing the more advanced cases, 18 patients between 16 and 20 years of age were selected (Group B). The average age and the average estimated time since onset for Group A were 12 years 1 month, and 3 years 10 months, respectively. The corresponding data for Group B were 16 years 7 months and 5 years 3 months. In these two groups, the majority of which were relatively young patients, 120 eyes were examined.

Also examined were 9 patients 21-30 years of age (Group C), and 34 patients over 30 years of age (Group D).

Prior to the examinations, the type of the disease was decided clinically, mainly on the basis of the cutaneous lesions; and the principal neural manifestations were noted. At the same time the presence or absence of trachoma was observed, and the visual acuity was measured. The anterior portion of the eye was then examined with the Hartnack loupe, and the results were compared with the findings with the biomicroscope.

Clinically and anatomically the cornea is the site of the earliest of the leprous conditions of the eye, so in the examination emphasis was placed on that structure. Changes in the capillaries and leprous infiltration in the limbus corneae, changes in the corneal nerve, and keratitis, which were considered early changes, were observed in detail.

The principal findings in Groups A and B are shown in Table 1. They are grouped by the clinical type of the disease, and by the age class.

The principal findings can be summarized as follows: 1. Neovasculari-

zation and leprous infiltration of the limbus corneae were observed only in lepromatous cases, in 88 per cent of Group A and 100 per cent of Group B.

2. Pannus leprous corneae was observed also only in lepromatous leprosy, in 70 per cent of Group A and 83.3 per cent of Group B.

The changes of these two kinds increased in severity in parallel with advancement of the manifestations of the disease.

TABLE 1.—*Findings in Groups A and B: Frequency of thickening of the corneal nerve, of changes in the limbus cornea, and of pannus corneae; by type of disease and age group.^a*

Type of leprosy	Age group	Thickening of the corneal nerve				Changes in limbus corneae		Pannus corneae	
		+	—	Bilateral	Unilateral	+	—	+	—
Lepromatous	A	29 (58)	21 (42)	13 (81)	3 (19)	44 (88)	6 (12)	35 (70)	15 (30)
	B	15 (62)	9 (37)	7 (87)	1 (12)	24 (100)	0	20 (83)	4 (17)
Neural	A	9 (28)	23 (72)	3 (50)	3 (50)	2b (6)	30 (94)	2b (6)	8 (94)
	B	2 (20)	8 (80)	1 (100)	0	2b (20)	8 (80)	2b (20)	8 (80)
Tuberculoid	A	1 (50)	1 (50)	0	1 (100)	0	2 (100)	0	2 (100)
	B	0	2 (100)	0	0	0	2 (100)	0	2 (100)
Total		56 (47)	64 (53)	24 (75)	8 (25)	72 (60)	48 (40)	59 (49)	61 (51)

a. The figures in the “+” and “—” columns are based on two eyes per case. Those in parentheses are percentages reduced to the nearest whole number.

b. Changes due to trachoma.

3. The beaded corneal effect was observed in cases of all types but was most frequent in the lepromatous one, found in 58 per cent of the Group A cases and 62.5 per cent of Group B. In the neural type the corresponding percentages were 28.1 and 20.0, while in the tuberculoid type this condition was observed in only one eye of the four examined. This condition was symmetrical (bilateral) in a large majority of the cases, with special reference to the lepromatous cases. No other difference was noted in the nerve thickening between the lepromatous and neural types.

It is believed that the disturbances of the peripheral nerves of other parts of the body, e. g., paralysis of the facial, ulnar, median, radial nerves, or paresthesias, thickening of the various nerves, are not closely related to the bead-like changes in the corneal nerve.

DISCUSSION

The results here reported show the leprosy changes in the eye that occur earliest and most frequently are to be observed in the cornea with the slit-lamp microscope. The most important for early diagnosis are those in the limbus corneae, followed by pannus corneae and changes in the corneal nerve, in the order named.

Young as were the 25 patients with lepromatous leprosy in Group A, and short as was the duration of the disease in them, changes in the limbus corneae were found in 88 per cent, pannus corneae in 70 per cent, and the beaded corneal effect in 58 per cent. In 5 of these cases it was estimated that less than one year had elapsed since onset, and yet changes in the limbus corneae were already present in all five, and pannus corneae and changes in the corneal nerve in 4 of them. From the frequency with which these changes were found it can be seen how early and often the cornea is invaded in lepromatous leprosy. And yet visual acuity was more than 1.0 in the 25 lepromatous cases in Group A, except for one case of myopia, so at first glance ophthalmic disorders seemed very rare.

Elliot has reported that leprous keratitis was absent in a series of 14 patients whose average age was 12.3 years, and that this condition was first observed in the 14-year group. In this study, however, pannus corneae was found in 70 per cent, i. e., in 35 out of the eyes of 25 lepromatous patients whose average age was 12 years 2 months. In 8 of these 35 eyes, the pannus corneae could not be observed with the Hartnack loupe.

There are many theories about the mechanism of formation of lesions unaccompanied by development of blood vessels in the cornea, a non-vascular tissue. It has been reported by Mitsuda and Shionuma that there is invasion of leprosy bacilli in the cornea in some cases even when cellular infiltration cannot be proved histopathologically. This is an extremely interesting problem.

Observation of the course of the keratitis with the slit-lamp microscope during treatment shows that there is gradual disappearance of the pannus corneae in light cases, and it might be thought that this should serve as a mark for the determination of therapeutic effects. In this study it was found, when adequate treatment was instituted at an early stage in light cases of lepromatous leprosy, that the infiltrations of the skin were absorbed well and that after several years they could not be recognized macroscopically; and the leprosy bacilli were greatly reduced in numbers. However, there were not a few cases in which pannus corneae could still be observed. The value of biomicroscopic findings in keratitis in the determination of therapeutic effect thus becomes questionable.

Elliot has given the beaded effect of the corneal nerve an important role in the early diagnosis of leprosy. This beaded effect is not seen in other ophthalmic conditions, and the only finding which must be differentiated is the floating web-like membrane seen in the normal corneal nerve. A study was made of 20 normal eyes, and a single case of floating web-like membrane was observed. The beaded effect was totally absent.

The findings that have been discussed were mostly in Group A, i. e., the 25 patients with lepromatous leprosy among the 42 patients in the group aged 15 years or younger. The changes in the cornea were more advanced in Groups B, C, and D, and they were closer to keratitis paren-

chymatosa rather than pannus corneae. Lesions in the iris were present in a high percentage of these cases. In many of them changes in the corneal nerve could not be observed because of the keratitis parenchymatosa.

Measures against trachoma are carried out extensively in the lepro-saria in Japan, and in only 5 of the 103 cases examined was that condition found. Differentiation between the trachomamous and leprous capillary development in the limbus corneae is not difficult, as has been noted by Vale and others.

With regard to the relation between type of the disease and the slit-lamp microscope findings in the leprous cornea, changes in the limbus corneae and keratitis were found only in the lepromatous type. It has already been shown by Mitsuda (9), Shionuma (12), and others that pannus leprosus corneae is histologically a lesion consisting of diffuse or localized leprous cellular infiltration with bacilli beneath the Bowman's membrane, and the microscopic findings in this study coincided well with such histological findings. It is suggested that slit-lamp microscope examination could be a valuable aid in the determination of the type.

In the younger patients studied the leprosy changes were in general slight, and as treatment was started relatively early many of the lepromatous cases gave the appearance of neural leprosy after several years' treatment. It was often possible to prove the presence of lepromatous changes by the history of the illness, the Mitsuda reaction, finding of bacilli in the lesions, and biopsy; but the cases were not few in which the type could readily be determined by the slit-lamp microscope findings. For example, in 8 of the 25 lepromatous cases in Group A, infiltration in the face and limbus was almost indiscernable and the clinical appearance was of neural leprosy, but with the biomicroscope leprous changes in the limbus corneae were observed in 6 of them, and pannus corneae in 4.

SUMMARY AND CONCLUSIONS

1. The eye, especially the early leprous changes in the cornea, was examined with the slit-lamp microscope in 103 cases of leprosy. The anterior portion of the eye was also examined with the Hartnack loupe, and the findings compared with those of the microscopic examination. Acuity of vision was measured. The relationship between the findings and the clinical type of the disease was also studied.

2. The patients were divided into four groups according to age. Group A, consisting of 42 cases under 15 years of age (average 12 years 1 month), and Group B, 18 cases between 16 to 20 years of age (average 16 years 7 months) were studied in detail. The estimated average duration of the disease in these groups were 3 years 10 months and 5 years 3 months, respectively.

3. Neovascularization and leprous infiltration in the limbus corneae

were observed only in the lepromatous type. They were found in 88 per cent of such cases in Group A, and 100 per cent of them in Group B.

4. Pannus leprous corneae was also found only in the lepromatous type, in 70 per cent of such cases in Group A and 83 per cent in Group B.

5. These changes were greater with increase of age, of duration of the disease, and of severity of its manifestations.

6. The beaded corneal effect was found in all types, most frequently (about 60%) in the lepromatous cases, much less so in the other types. The changes were bilateral in most cases, and there was no significant difference in the degree of thickening of the nerve in the lepromatous and neural types.

7. In 20 normal controls, the floating web-like membrane in the cornea was observed in only one case, and none showed the bead-like change that occurs in the leprous eye.

8. It is concluded that the findings in the leprous cornea with the slit-lamp microscope, especially in mild lepromatous cases, are a valuable supplement for determining the type.

9. The significance in the early diagnosis of leprosy of findings in the cornea with the slit-lamp microscope is discussed, it being held that the beaded effect of the corneal nerve, when accompanied by changes in the limbus corneae and pannus corneae, is an aid in diagnosing leprosy.

RESUMEN Y CONCLUSIONES

1. En 103 casos de lepra, se examinó con el microscopio de lámpara de hendidura el ojo, prestando atención especial a las alteraciones leprosas incipientes en la córnea. También se examinó la porción anterior del ojo con la lupa de Hartnack, comparándose los hallazgos con los del examen microscópico. Se midió la agudeza de la visión. Se estudió además la relación entre los hallazgos y la forma clínica de la enfermedad.

2. Los enfermos fueron divididos en cuatro grupos de acuerdo con la edad. El Grupo A, compuesto de 42 sujetos de menos de 15 años de edad (promediando 12 años y 1 mes) y el Grupo B, de 18 sujetos de 16 a 20 años de edad (promediando 16 años y 7 meses), fueron estudiados a fondo. La duración media calculada de la enfermedad en estos grupos fué de 3 años y 10 meses y de 5 años y 3 meses, respectivamente.

3. Se observaron neovascularización e infiltración leprosa en el limbo de la córnea únicamente en la forma lepromatosa, encontrándose en 88 por ciento de esos casos en el Grupo A y en 100 por ciento de ellos en el Grupo B.

4. Tampoco se observó pannus en las córneas leprosas más que en la forma lepromatosa: en 70 por ciento de estos casos en el Grupo A y en 83 por ciento en el Grupo B.

5. Esas alteraciones fueron mayores al acrecentar la edad, la duración de la enfermedad y la gravedad de sus manifestaciones.

6. Observóse el efecto moniliforme en la córnea en todas las formas, más frecuentemente (60% aproximadamente) en los casos lepromatosos, mucho menos en las demás formas. Las alteraciones fueron bilaterales en la mayoría de los casos, sin que hubiera mayor diferencia en el grado de engrosamiento del nervio entre los casos lepromatosos y los neurales.

7. En 20 testigos normales, no se observó más que en un caso la membrana palmeada flotante en la córnea, sin que ninguno revelara la alteración moniliforme que se nota en el ojo leproso.

8. Dedúcese que los hallazgos obtenidos en la córnea leprosa con el microscopio de lámpara de hendidura, sobre todo en los casos lepromatosos leves, constituyen un complemento valioso para determinar la forma del mal.

9. Discútese la importancia que revisten en el diagnóstico temprano de la lepra los hallazgos con el microscopio de lámpara de hendidura, sosteniéndose que el efecto moniliforme en le nervio corneano, cuando va acompañado de alteraciones en el limbo de la córnea y de pannus en ésta, es de ayuda en el diagnóstico de la enfermedad.

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